APPENDIX B.6 MIDDLE WABASH SERVICE AREA
ELEMENT 1. SERVICE AREA DESCRIPTION

The Middle Wabash Service Area (SA) is located in western Indiana and is composed of all or part of the following six 8-digit HUC watersheds:

- 05120109 - Vermilion
- 05120108 - Middle Wabash-Little Vermilion
- 05120110 - Sugar
- 05120111 - Middle Wabash-Busseron
- 05120203 - Eel
- 05120113 - Lower Wabash (small portion)

The Middle Wabash SA includes all or portions of twenty Indiana counties listed below and is located primarily within both the Central Till Plain and Southern Hills and Lowlands physiographic regions.

Knox	Putnam	Clinton
Sullivan	Parke	Tipton
Greene	Hendricks	Tippecanoe
Owen	Vermilion	Warren
Clay	Boone	Benton
Vigo	Montgomery	White
Morgan	Fountain	

The Middle Wabash SA drains approximately 5,415 square miles of western Indiana and is located in a variety of ecoregions; the northernmost portion is located in Central Corn Belt Plains; the east-central portion is within the Eastern Corn Belt Plains and Interior Plateau; the south-central portion of the SA is in the Interior River Valleys and Hills. In the north, the land is characterized by dark, fertile soils; the land was once covered by prairie and oak-hickory forests but has been converted to agriculture. The southern area is composed of wide, flat-bottomed terraced valleys and dissected glacial till plains and contain loamy to sandy till deposits. The southern half of the Middle Wabash SA contains a large amount of Indiana's surface and underground mines, mainly in the Lower Wabash and Eel Watersheds. The remainder of the region in the east is primarily a level till-plain with broad bottomlands and is

characterized by soils which developed from loamy, limy glacial deposits; the soils are productive for agricultural crops, and a majority of the land use is agricultural (U.S. EPA: Ecoregions of Indiana).

The Wabash River enters the Middle Wabash SA in Tippecanoe County after its confluence with the Tippecanoe River and Wildcat Creek. The Wabash River travels south through Warren and Fountain Counties where it flows along the Indiana/Illinois border beginning in Vigo County; primary tributaries of the Wabash River within this SA include Sugar Creek, the Vermilion and Little Vermilion Rivers, and Big Raccoon Creek.

Based on the 2011 NLCD (Homer, et al., 2015), the land cover type with the most area in the Middle Wabash SA is agricultural land use (69.14%), followed by forest and scrub/shrub (20.1%), developed and impervious land use (7.9%), and wetlands and open water (1.7%). Woody wetlands are the prominent wetland type and range from approximately 0.48% per the 2011 NLCD to 2.22% per the NWI. Emergent herbaceous wetlands range from 0.11% per the 2011 NLCD to 0.47% per the NWI.

ELEMENT 2. THREATS TO AQUATIC RESOURCES

Aquatic resource threats specific to the Middle Wabash SA have been identified using the same approach as the statewide portion of the CPF. As objectively as possible, the threats are presented in the order of the current predominance within the SA.

2.1 Section 404 Permitted Impacts

The Corps Section 404 permit data for impacts that required mitigation in the Middle Wabash SA from 2009 – 2015 was collected and analyzed **(Table 64)**. According to the data, 564.2 acres of impacted wetlands and 742,293 linear feet of impacted streams required mitigation in the seven year time period.

The energy production and mining work type accounted for the most stream impacts (96.2%), followed by transportation and service corridors (2.53%), development (1.12%), and agricultural land uses (0.19%). There were no documented dam related stream impacts requiring mitigation for this time period.

The energy production and mining work type accounted for the most wetland impacts (95.92%), followed by transportation (3.49%), development (0.31%), agricultural impacts (0.15%), and dam related impacts (0.14%).

Work Type	Authorized Stream Impacts - Linear Ft	Percent of Stream Impact per Category	Authorized Wetland Impacts - Acres	Percent of Wetland Impact per Category
Agriculture	1,410	0.19%	0.821	0.15%
Dam	0	0.00%	0.77	0.14%
Development	8,298	1.12%	1.745	0.31%
Energy Production	713,804	96.16%	541.13	95.92%
Transportation	18,781.7	2.53%	19.698	3.49%
Grand Total	**742,293.7**	**100.00%**	**564.2**	**100.00%**

Table 64. Authorized 404 stream and wetland impacts requiring mitigation by work type category, 2009 – 2015
Source: USACE Louisville and Detroit Districts

Locations of the permitted stream and wetland impacts are provided in **Figure 75**.

Middle Wabash Service Area

404 Permitted Aquatic Resource Impacts Requiring Mitigation

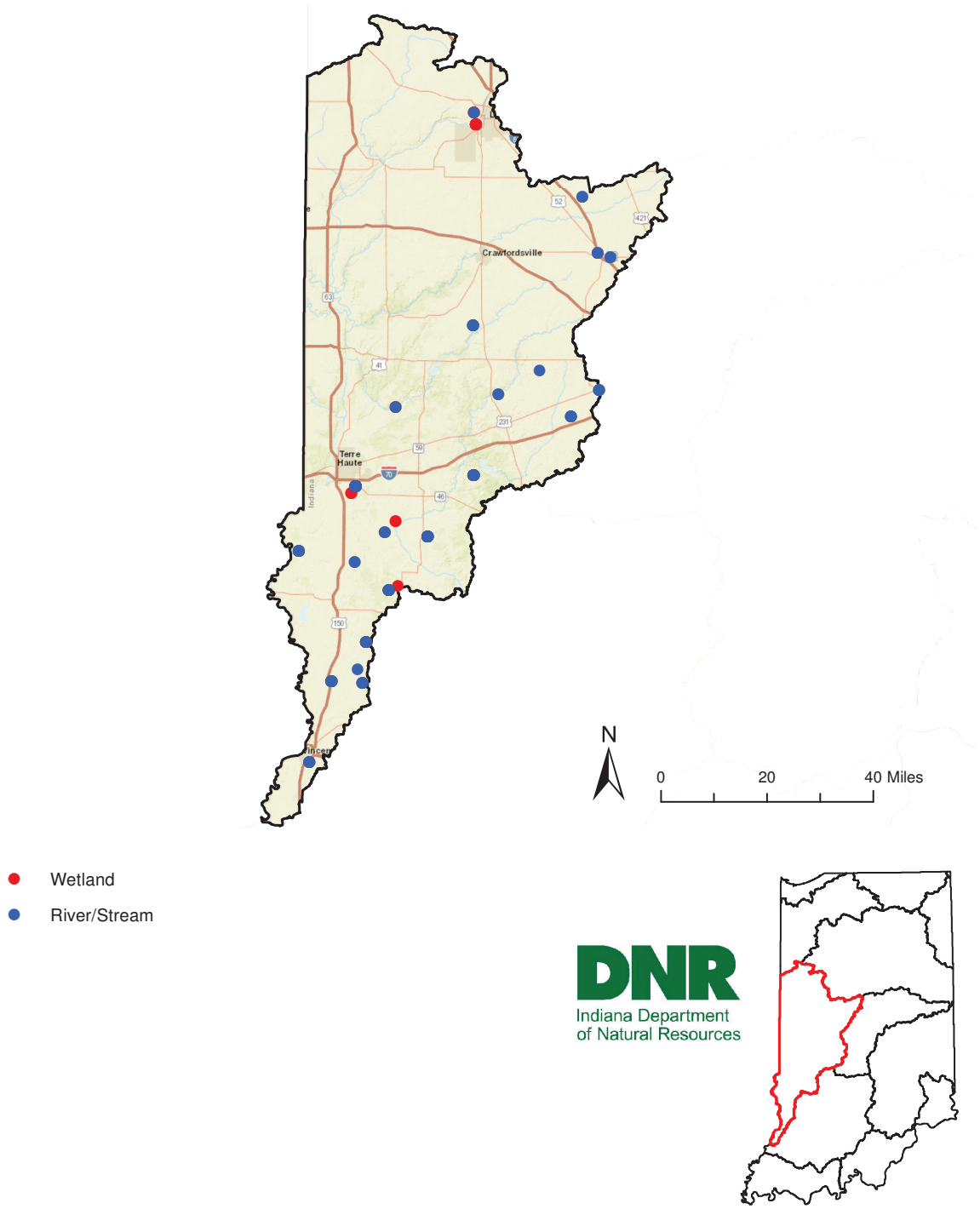

Figure 75. 404 permitted stream and wetland impacts requiring mitigation 2009- 2015

2.2 Land Cover and Land Use

In addition to 404 permitted work type categories, IDNR utilized the 2011 NLCD to identify land cover and land uses that contribute to aquatic resource and habitat impacts. Overall land cover within the Middle Wabash SA is presented in **Figure 76,** and displays the geographical relationship of converted cover types relative to naturally occurring cover types.

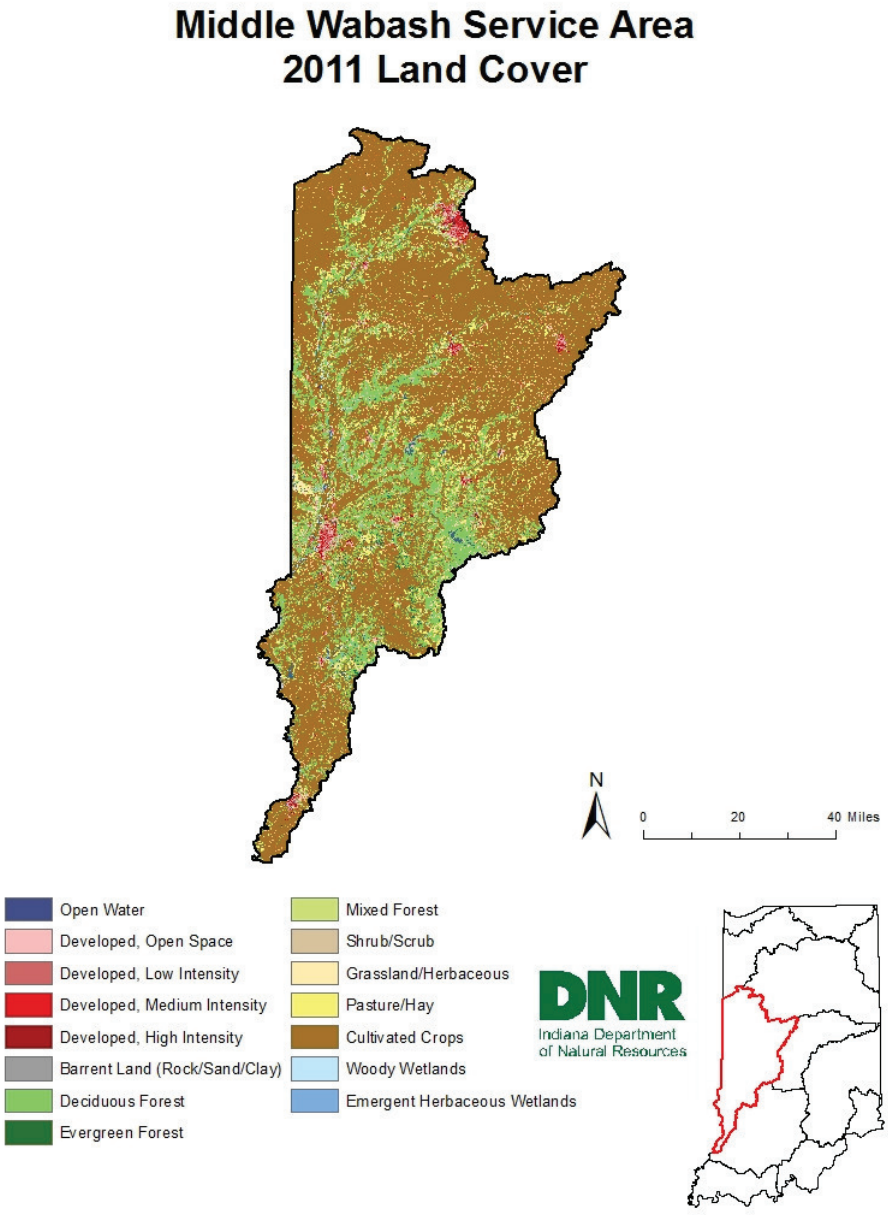

Figure 77. Land cover within the Middle Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

The land uses exhibited within the 2011 NLCD include multiple classes of cover, and some have additional values within specific classes based on variants or intensities within the classification **(Table 65)**.

Land Cover			
Class	Value	Sum of Acres	Percent of Total Acres
Open Water	*	38,022	1.10%
Developed	Open Space	182,656	5.27%
Developed	Low Intensity	65,138	1.88%
Developed	Medium Intensity	17,474	0.50%
Developed	High Intensity	7,979	0.23%
Barren Land (Rock/Sand Clay)	*	2,374	0.07%
Forest	Deciduous	683,931	19.74%
Forest	Evergreen	10,679	0.31%
Forest	Mixed	315	0.01%
Shrub/Scrub	*	1,047	0.03%
Grassland/Herbaceous	*	39,680	1.15%
Pasture/Hay (Agriculture)	*	190,113	5.49%
Cultivated Crops (Agriculture)	*	2,205,652	63.65%
Wetlands	Woody	16,518	0.48%
Wetlands	Emergent Herbaceous	3,667	0.11%
Grand Total		**3,465,243**	**100.00%**

Table 65. Middle Wabash SA land cover/classification/value percentages from 2011 National Land Cover Database
*** Class does not have additional values. (Homer, et al., 2015)**

IDNR combined the values within the same land cover classification in **Figure 77** below to demonstrate the current overall land cover distribution of the SA.

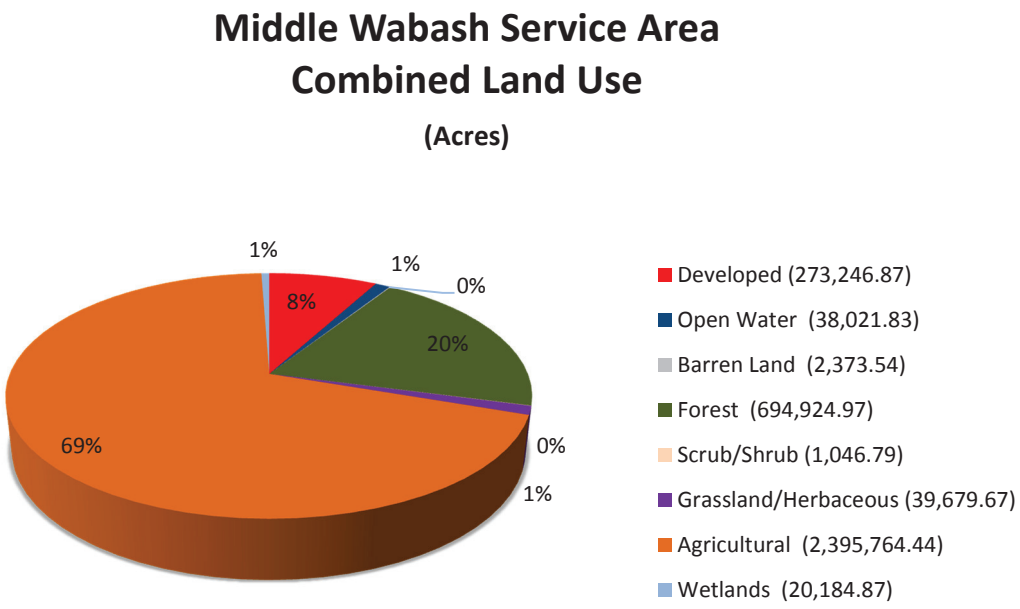

Figure 77. Combined land uses within the Middle Wabash Service Area from the 2011 NLCD (Homer, et al., 2015)

2.3 Agricultural Land Use

Agricultural land use is the largest land use in the Middle Wabash SA. Total agricultural land use covers approximately 69% of the SAs total land area of 2,395,764 acres (Homer, et al., 2015). Agricultural land uses occur throughout the SA, with the exception of the distribution of a few pockets of developed areas, such as Terre Haute and West Lafayette.

Within the identified land use areas, cultivated crops cover over 2,205,651 acres (63.65%) and pasture/hay lands cover 190,113 acres (5.49%) of the SA (Homer, et al., 2015). Corn production is the primary cultivated crop based on USDA 2015 harvested crop production survey data from counties that comprise the majority of the Middle Wabash SA (United States Department of Agriculture, 2016 and 2017).

Pasture/hay lands support livestock production for small to major livestock farming operations throughout the SA. Since the Middle Wabash SA is the second largest SA with a total area of approximately 3,465,243 acres and contains pork, dairy, and beef cattle CFOs, which require a minimum of 5,000 animal units (Thompson, 2008). When combining these major agricultural land use activities, the Middle Wabash SA ranks second in percentage of total statewide land use (10.35%), and it's a significant land use throughout the SA.

2.4 Growth and Development

Developed impervious area is the third largest land use after agricultural and forested cover, covering approximately 273,247 (7.89%) of the 3,465,243 total acres, tied for third least developed area density across all SAs. In general, the two largest developed areas are the communities of Lafayette-West Lafayette and Terre Haute, both along the Wabash River, as well as I-65 and I-70 respectively. Other footprints of high intensity development include communities such as Lebanon, Crawfordsville, Greencastle, Brazil, Sullivan and Vincennes.

The SA contains portions of the Lafayette-West Lafayette, Indianapolis-Carmel-Anderson, Terre Haute and Bloomington MSAs, all of which experienced growth in the previous decade (Manns, 2013). Approximately 98% (931,934 acres) of the Terre Haute MSA is within the Middle Wabash SA which includes all of Vermillion, Vigo and Clay counties, and 94% of Sullivan County, accounting for approximately 27% of total SA acres. The core of the Terre Haute MSA is within Vigo County which accounts for approximately 28% of this MSA, and approximately 8% of total SA acres.

Approximately 24% (670,406 acres) of the Indianapolis-Carmel-Anderson MSA is within the Middle Wabash SA which includes portions of Boone, Hendricks, and Morgan Counties, and the entirety of Putnam County, accounting for approximately 19% of total SA acres. Approximately 46% (381,248 acres) of the Lafayette-West Lafayette MSA is within the Middle Wabash SA which includes portions of Benton and Tippecanoe Counties, and accounts for approximately 11% of total SA acres. The core of the Lafayette-West Lafayette MSA is within Tippecanoe County which accounts for approximately 62%

of this MSA with approximately 74% (238,220 acres) of Tippecanoe County's 321,920 acres within the Middle Wabash SA, accounting for approximately 7% of total SA acres. Approximately 19% (98,404 acres) of the Bloomington MSA is within the Middle Wabash SA which includes only a portion of Owen County, and accounts for approximately 3% of total SA acres. Analysis of the INDOT cities towns GIS data shows the Middle Wabash SA contains all or part of 351 cities and/or towns, 86 of which are incorporated (INDOT, 2016).

Four Indiana regional councils that overlap with the SA include the West Central Indiana Economic Development District (44%), Kankakee-Iroquois Regional Planning Commission (12%), Southern Indiana Development Commission (5%), and the North Central Indiana Regional Planning Commission (2%) (IARC, 2017).

According to the West Central Indiana Economic Development District's 2012 CEDS, this region is served by two interstate highways, I-70 and I-74, in addition to many other major U.S. and state highway routes which allow for a substantial amount of commuters from outside this area. This excellent network of transportation facilities provides business and industry ready access to global and domestic suppliers and markets that include Indianapolis, Chicago, St. Louis and Columbus. The top four business sectors for this region are government, manufacturing, retail/wholesale trade, and health care and social services (WCIEDD, 2012).

Additionally, analysis of INDOT's local roads GIS data shows there are approximately 12,054 miles of municipal and county roads contributing to the developed impervious land cover within the SA (INDOT Road Inventory Section, 2016). The Middle Wabash SA ranks ninth among SA's in local road miles to square mile ratio at approximately 2.23 miles of local roads per square mile.

2.5 Transportation and Service Corridors

2.5.1 Roads

The Middle Wabash SA contains approximately 1,324 miles of U.S. Interstates and highways, 2,936 miles of state highways, and 12,054 miles of local roads with in its boundary (INDOT Road Inventory Section, 2016). Although this is the second largest SA, the concentration of the various road types per square mile of land has varying distribution within the SA.

U.S. Interstates and highways have a concentration of approximately 0.24 mile per square mile, which ranks last among the eleven SAs making this the lowest ranking road type within the state and SA. Although the concentration of U.S. Interstates and highways has the lowest ranking, the concentration of state roads ranks fifth with 0.54 mile per square mile and is the highest ranking road type within the Middle Wabash SA. Similar to the U.S. roadways, the ranking of the concentration of local roads falls near the bottom. The concentration of local roads is approximately 2.23 miles per square mile, which ranks ninth when compared to local roads rankings for the ten other SA. Similarly, the combined ranking of the concentration for all roadways ranks near the bottom with a concentration of 3.01 miles

per square mile ranking tenth overall. The construction and maintenance of roads and bridges throughout the Middle Wabash SA will play an integral role in sustaining business and commerce within the region.

2.5.2 Railroads

As an alternative mode of transportation, the Middle Wabash SA has approximately 1,244 miles of railroad within the SA boundary (Federal Railroad Administration, 2002). These active railroads provide an important means of transportation for freight and passengers throughout the SA and state. The Middle Wabash SA contains the fifth largest concentration of railroads with a density of 0.23 mile per square mile. The concentration of linear infrastructure throughout the SA contributes to aquatic resource threats that include habitat fragmentation, disruption to fluvial processes, resource degradation, conversion and loss of aquatic resources.

2.5.3 Service Corridors

Similar to threats associated with roads and railroads, the Middle Wabash SA contains service corridors, which also result in aquatic resource impacts and habitat loss associated with these types of linear infrastructure. The SA contains over 3,911 miles of service corridors within its boundary.

The Middle Wabash SA contains an extensive network of large kilovolt (kV) electric transmission lines within its boundary. The large kV transmission lines identified within the SA include approximately fifty-one (12 kV) lines, 154 (34.5 kV) lines, 276 (69 kV) lines, 153 (138 kV) lines, forty-one (230 kV) lines, seventy-two (345 kV) lines, and three (765 kV) lines (Indiana Geological Survey, 2001). These lines extend over 2,005 miles throughout the SA, which is tied with the St. Joseph River SA for the seventh highest concentration of electric transmission lines relative to the SA size with 0.37 mile of transmission line per square mile.

In addition to electric transmission lines, the Middle Wabash SA contains over 1,906 miles of pipelines in total. It contains over 226 miles of pipelines that convey crude oil, 1,136 miles of pipelines that transport natural gas, and 544 miles of pipelines that deliver refined petroleum products (Indiana Geological Survey, 2002). When compared to the other SAs throughout the state, the Middle Wabash SA contains the second greatest concentration of crude oil pipelines, the third greatest concentration of natural gas lines, and the greatest concentration of refined petroleum product pipelines.

2.6 Dams and Non-Levee Embankments

There are currently 11 known low head dams (IDNR DOW, 2016) within the SA, the fourth least among all SAs and second to last in concentration at one low head dam per 492 square miles. There are currently 141 state regulated high head dams (IDNR DOW, 2016) documented within the SA at a density of one dam per 38 square miles, the third highest concentration among all SAs with 16% of documented high head dams statewide.

Per the NLE GIS (IDNR, 2016) analysis, there are approximately 1,589,280 linear feet (301 miles) of NLE's mapped within the SA, averaging one mile of NLE per 18 square miles which is tied for the third highest concentration among all SAs. Warren County was not included in the NLE identification project since it was not a declared disaster resulting from the 2008 severe weather events. Approximately 198 miles of the currently identified NLE's are located within predominantly developed areas, with the remaining 103 miles mapped in rural agricultural settings.

2.7 Energy Production and Mining

2.7.1 Coal

The Middle Wabash SA contains historic and active coal mining operations within its boundary. Based upon IDNR-Division of Reclamation (DOR) surface and underground coal mining dataset, coal mining operations were first documented in 1835 and have effected over 229,685 acres (Gray, Ault, Keller, & Harper, Surface Coal Mines in Indiana, 2010); (Gray, Ault, Keller, & Harper, Underground Coal Mines in Indiana, 2010). However, further analysis of surface and underground mining data operation footprints and permitting history provides insight into coal mining lineage within the SA.

Mining operations, prior to the issuance of the SMRCA of 1977, were not required to implement post mining reclamation. The Middle Wabash SA contained approximately 755 surface coal mines, which totaled approximately 55,015 acres and 1,129 underground coal mines, which totaled 127,726 acres of Pre-SMCRA coal mining operations. These Pre-SMCRA surface mining operations impacted 1.59% of the SA land cover, which ranks last of the three coal bearing SAs. In contrast, Pre-SMRCA underground mining operations impacted 3.69% of the SA land cover, which ranks first, earning the highest concentration.

Permitted surface and underground mining operations that are regulated by SMRCA of 1977 are prevalent throughout the SA. The IDNR-DOR have recorded over 188 surface coal mining operations which total approximately 31,530 acres and over 39 underground mining operations; that total approximately 15,414 acres throughout the Middle Wabash SA. These surface mining operations impact over 0.91% of the SA land cover, which ranks last among the SAs. Similarly, the concentration of underground mining operations ranks last with 0.44% of SA land cover among the coal-producing SAs.

The Middle Wabash SA is the largest SA that contains coal, with approximately 3,465,243 acres, and it has experienced extensive mining impacts. Surface mining has resulted in cumulative impacts to approximately 86,545 acres, altering over 2.5% of the SAs land cover. Similarly, cumulative underground mining impacts have altered over 69,861 acres of the Middle Wabash SA, which ranks last with a concentration of 2.39% of the SA land cover.

2.7.2 Natural Gas and Oil Production

The Middle Wabash SA contains a multitude of active oil and gas fields, along with associated wells that are currently supporting, or have supported, the petroleum industry within the SA. The Indiana Geological Survey (IGS) identifies 42 petroleum gas fields with 272 associated gas wells; 36 oil fields with 371 oil wells; and 18 oil & gas fields with two oil & gas wells ranking the Middle Wabash SA third statewide for active natural gas and oil fields (Indiana Geological Survey , 2015).

The Middle Wabash SA also contains a series of wells that are supplemental to, or associated with, the petroleum industry as identified within the IGS statewide well dataset. The IGS petroleum well data identifies 184 abandoned gas wells, 1,135 abandoned oil wells, six abandoned oil & gas wells, 3,878 dry wells, 33 observation wells, 753 stratigraphic wells, 43 saltwater disposal wells, 54 abandon saltwater disposal wells, 108 temporarily abandoned wells, 10 potable water supply wells, 10 non-potable water supply wells, 29 water injection wells, 72 gas storage, 32 abandoned gas storage, 15 abandoned observation wells, two abandoned waste disposal wells, 66 abandoned water injection, 35 abandoned oil and water injection, one waste disposal well, within the SA (Indiana Geological Survey, 2015).

2.7.3 Mineral Mining and Aggregates

The Middle Wabash SA contains active mineral mining operations that extract and produce aggregate commodities. Based on the Indiana Geological Survey (IGS) 2016 active Indiana industrial mineral production data, this SA contains 20 sand & gravel mining operations, 10 clay and shale mining operations, seven crushed stone operations, and one dimensional sandstone quarry operation (Indiana Geological Survey, 2016). In addition to the extraction of raw material aggregates, the SA includes one slag operation and cement operation, which are industry byproducts commodities that are used as aggregate (Indiana Geological Survey, 2016). In addition to the Middle Wabash SA ranking second based on its size mineral mining within in this SA ranks it second in the state among all of the SAs with 40 active operations.

2.8 Indiana State Wildlife Action Plan (SWAP) Identified Threats

The Middle Wabash SA contains part of the Indiana SWAP Corn Belt (58.5%), Valleys and Hills (36.5%), and Interior Plateau (5%) Planning Regions. The SWAP identifies the most significant threats to habitats and SGCN overlapping these planning regions as:

- Habitat conversion, fragmentation and loss
- Natural systems modification
- Invasive species
- Dams
- Fish passage
- Point and non-point source pollution
- Water management and use
- Housing and urban areas
- Commercial and industrial areas
- Agriculture, aquaculture, livestock
- Roads and service corridors
- Changing frequency, duration, and intensity of drought and floods

These SWAP planning regions has experienced loss in the majority of habitat types over the last decade mostly to urban development (SWAP, 2015).

2.9 Anticipated Threats

The existing land uses within the agricultural and developed impervious footprints make up approximately 77% of the land use within the SA and are expected to remain as the top contributors to aquatic resource impairments.

IDNR expects energy production and mining, specifically surface coal mines, to remain the foremost permitted activity requiring mitigation followed by transportation and service corridors, and development projects if the 404 permitting trends of the past 7 years continue.

The SA is rich in agricultural and timber resources. The agricultural sector continues to be an important part of the regional economy and has an abundance of natural resources which are important to the national energy supply including large amounts of recoverable coal, natural gas, water supplies and reserves of crude oil (WCIEDD, 2012). Abandoned mines will continue to negatively impact the chemical, physical and biological integrity of aquatic resources. Among the numerous threats to aquatic resource functions and services in these environments, invasive species will continue to thrive unless restoration and enhancement efforts are increased and long term management implemented.

The reserves of industrial minerals such as sand, gravel and clay, while not used to the extent they once were, are still an important factor in the local economy. For instance, after virtually disappearing, the manufacturing of clay brick has made a strong comeback in the past several years with manufacturing facilities being built and operated in Clay, Sullivan, and Vermillion Counties (WCIEDD, 2012).

Inadequate sanitary sewage treatment remains a major obstacle for several counties in the SA. Storm water management has become an important issue over the last 10 years due to the increases in flooding of these communities and the adverse effect storm water can have on existing wastewater systems (WCIEDD, 2012).

The major economic development and growth goals for this region include improvement and expansion to infrastructure such as waste and storm water systems, industrial and business sites, all transportation systems, telecommunications, and housing (WCIEDD, 2012).

It is anticipated that the State Road 641 Terre Haute Bypass will attract new development as the roadway provides access to currently undeveloped land in addition to improved access to and between existing commercial and industrial parks within Vigo County as has been seen with other new road construction/improvement projects across the state.

2.10 Offsets to Threats

IDNR will apply the same restoration, enhancement and/or preservation approaches to help offset the predominant threats in the Middle Wabash SA that were stated in the statewide portion of the CPF. The SA goals and objectives further define the general types and locations of the aquatic resources IDNR will provide as compensatory mitigation based upon identified threats, historic loss and current conditions. See **Appendix C** for a summary of offsets per major anthropogenic category and a general matrix of offset measures for each of the predominant threats to aquatic resources throughout the SA and the state.

ELEMENT 3. HISTORIC AQUATIC RESOURCE LOSS

The Middle Wabash SA's historic aquatic resources were comprised of a diverse mix of natural aquatic communities associated with large river systems and bottomlands due to the Wabash River that extends through the northern portion of the SA, before flowing to the southwest along its western boundary. The southern reaches of the Wabash River grew some of the most impressive presettlement forest stands in the Eastern Deciduous Forest Biome (Jackson, 2006); (Petty & Jackson, 1966). Although the SA contained these natural communities and resources, the increase in the number of settlers to the area and their need for resources led to permanent alteration of the landscape.

The Wabash River played an import role in establishing settlements throughout the State and the oldest settlement within the state was located within this SA. Upon settlement, they transformed the region to support their way of life. In 1708, French settlers began clearing the land for orchards, gardens, to construct cabins and churches and eventually established Vincennes which became the territorial capital (The History Museum, 2017). This began the performance of land alterations for timber and agricultural land uses.

The landscape was comprised of impressive stands of hardwood and bottomland forests. The stands of hardwood trees throughout the Lower Wabash Valley were likely the most magnificent that occurred anywhere throughout the Eastern Deciduous Forest Biome (Jackson, 2006). Based on records collected by Robert Ridgeway, who was an early naturalist from the region, he found that virgin forests in the region averaged a canopy height that was 130 feet with some of the tallest tulip and sycamore trees approaching 200 feet (Ridgeway, 1872); (Jackson, 2006). In addition, the southern extent of the SA contained cypress swamps which encompassed the largest northern representation of the species with in the state and North America. Little Cypress Swamp in Knox County contained a bald cypress tree that was recorded at 81.5 inches in diameter and was speculated to be the largest living tree in Indiana at the time (Lindsey, Petty, Sterling, & VanAsdall, 1961); (Jackson, 2006). These impressive stands of forests were cut for timber and converted to agricultural land.

As the region's landscape was converted by settlers, they altered the region's aquatic resources as well as they sought to utilize the forest's resources for economic benefits. The northern region of the SA experienced similar impacts to aquatic resources that were felt throughout the state. Waterways were dammed to power mills to supply grain and lumber. In the 1850's the Pine Hill area had a saw mill added to the Deer and Canine grist mill to facilitate timber cutting within the region (Indiana Department of Natural Resources, 2014). In 1868, Clifty Creek was dammed by the Pine Hill Woolen Mill Company, diverting water to a wooden flume to power the mill by a water wheel (Indiana Department of Natural Resources, 2014). Many of the regions streams, rivers and adjacent wetlands were altered by early settlers for these uses.

Transportation played a major role in transforming the landscape throughout the SA. The Wabash and Erie Canal extended through the SA, following the Wabash River to Terre Haute, then south making its way to Evansville (The History Museum, 2017). The impacts associated with the construction of the Wabash and Erie Canal permanently altered the region's aquatic resources. In addition to alteration of waterways, stream flows, and conversion of wetlands for canal construction, reservoirs were constructed to supplement canal water levels. A critical highpoint in the canal system south of Terre Haute resulted in the construction of the Birch Creek Reservoir that covered 1,000 acres and the Splunge Creek Reservoir that covered 4,000 acres (Canal Society of Indiana, 2006). The construction of these impoundments altered and converted all waterways and natural communities within the 5,000 acre foot print.

Early roads that extended through the SA provided an important transportation network connection to important settlements. One of Indiana's first roads, a former bison trail, connected Vincennes to New Albany and was called the Buffalo Trace (The History Museum, 2017). Roads provided insight into the settlers' land use throughout the region due to the majority of commodities being sold and shipped along these transportation networks. The Buffalo Trace was used during the mid-1700s by early American settlers to facilitate commerce, move livestock between Louisville and Vincennes, and settle the Northwest Territory (Snell, Jackson, & Krieger, 2013). In addition to the Buffalo Trace, the Middle Wabash SA was influenced by another major roadway, the National Road, which reached Indiana by 1829 and extended from Terre Haute to Richmond eventually providing a link from St. Louis to Maryland (The History Museum, 2017).

In addition to canals and roadways, the SA was impacted by the introduction and use of railroads. Similar to other regions of the state, railroads were constructed as a means to travel and transport commodities. In 1897, the Evansville & Terre Haute Railroad constructed railroad tracks in order to transport logs and lumber from the mills and forests of the region (Wright, 1897). The majority of the area's forests were lost and aquatic resources destroyed. The Bison Trail connected Vincennes to other trade routes that sustained settlers within the region. In the 1850s the railroad, constructed

north of and parallel to the Buffalo Trace, connected Vincennes regionally from east to west by providing a regional link to St. Louis and Cincinnati (Indiana's Historic Pathways, 2010).

The Middle Wabash SA is one of the three SAs in the southwest portion of the state that contains coal. Both surface and underground coal mining has a deep rooted history within the SA. The first discovery of coal in Indiana was in 1736 along the Wabash River and reports in land surveys and maps have been documented in 1804 (Stevens, 2012). Years of mining impacts have degraded, converted, fragmented and eliminated aquatic resources throughout the region. Historically, the majority of mined land in the western region of the Middle Wabash SA was abandoned without any restoration efforts; acid mine drainage degraded many aquatic systems due to low pH to the point where waterbodies were devoid of local flora and fauna. Historical impacts from coal mining activities in the area included seeping, acidic water and heavy metals contamination (IDNR Division of Reclamation, 2010).

During the early 1900s, the Wabash River within the Middle Wabash SA was characterized as being brown and opaque with suspended sediments from Attica to Vermillion County. Reports from the mid-1990s identified sewage, mill and cannery waste, coal mine drainage, and dairy production wastes as sources of water quality impairments within the middle Wabash River, and increased flooding caused by an inadequate number of runoff channels and man-made landscape alterations; the Wabash River and its tributaries were polluted as a result of flood events. Up until the mid-1980s, the Wabash River continued to be degraded due to agricultural development and urbanization. Since this time, major improvements to water quality have been made, such as point source pollution reductions; however, high nutrient concentrations and PCB and mercury levels in fish tissue continue to exist within areas of the river and its tributaries (Wabash River Enhancement Corporation, 2011).

Due to extensive and prolonged aquatic resource loss within the Middle Wabash SA, the understanding of the region's aquatic resources and the natural communities in which they existed is best reconstructed by evaluating the identified Natural Regions and Sections, and their related natural aquatic communities, associated within each respective Region and Section. **Figure 78**, depicts each Natural Region and Section, located within the Middle Wabash SA, and identified within the Natural Regions of Indiana journal. In addition to the natural communities, the utilization of studies on Indiana's historic vegetative cover and mapped hydric and partially hydric soils provide further insight into the general location and makeup of the historic aquatic resources that existed before early European settlement initiated their prolonged loss **(Table 66)**. The table details the SA's estimated land cover percentages for each region and section, identified natural communities, estimated hydric and partially hydric soils, and estimated forest cover.

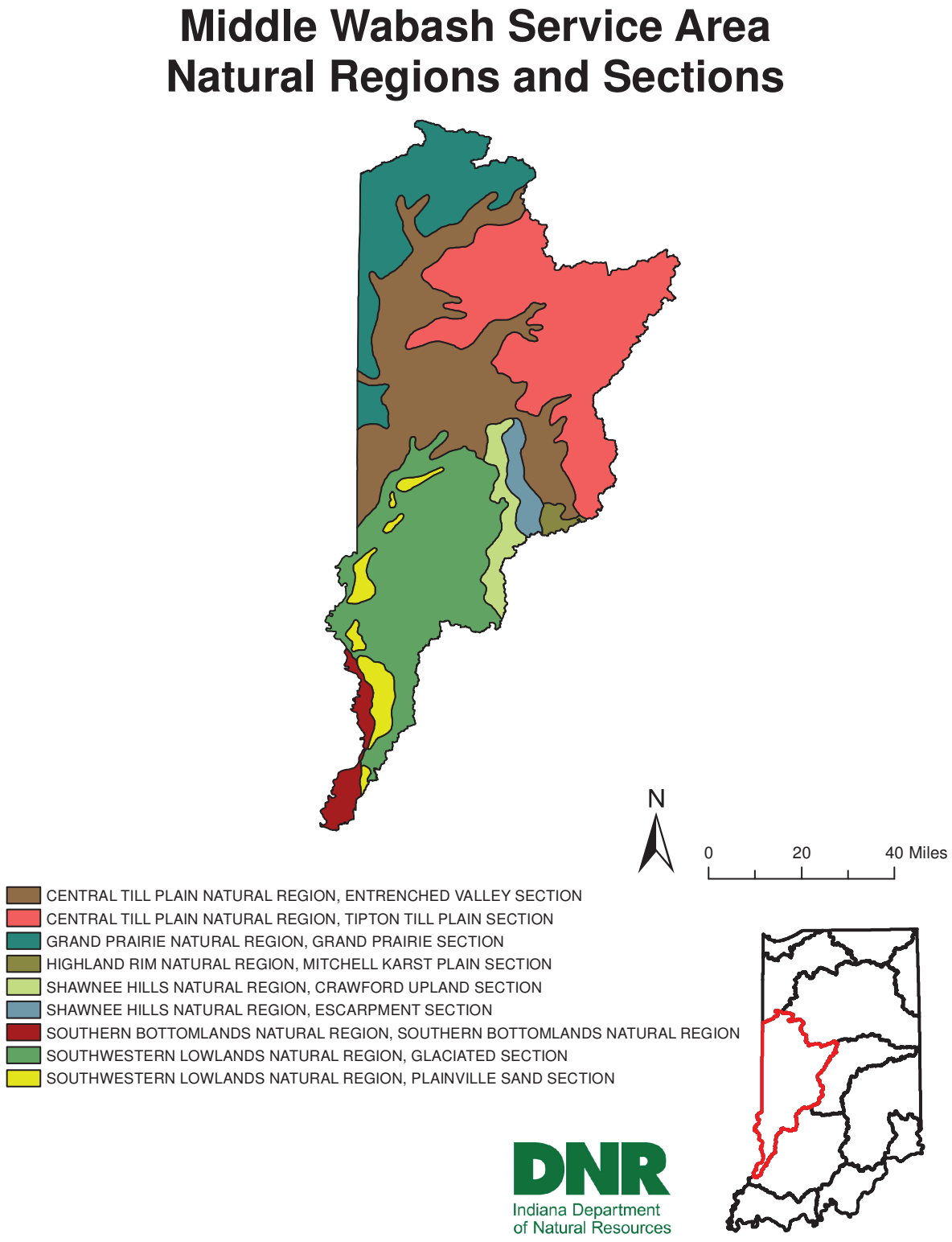

Figure 78. Natural regions and sections within the Middle Wabash Service Area (Homoya, Abrell, Aldrich, & Post, 1985)

Natural Region(s)	Natural Region: Section(s)		Natural Region Community Types	Hydric Soils		Partially Hydric		Pre-Settlement % Forest Cover
	Name	% Cover		Acres	% Cover	Acres	% Cover	% Forested
Central Till Plain	Tipton Till Plain	27.15	Extensive beech-maple-oak forest, northern flatwoods; bog, prairie, marsh, seep spring, and pond	560,783	16.18	425,612	12.28	79.86
	Entrenched Valley	24.81	Predominantly upland forests, bottomland forests, and flatwoods; prairie, gravel-hill prairie, fen, marsh, savanna, cliff, seep spring, and pond; Typical streams medium-gradient, relatively clear, and rocky					
Southwestern Lowlands	Plainville Sand	3.16	Barrens (rare); swamp, marsh, and wet prairie					
	Glaciated	23.04	Predominantly forest types (flatwoods community); prairie, swamp, marsh, pond, and low-gradient streams					
Grand Prairie	Grand Prairie	13.84	Dry prairie, wet prairie, savanna, marsh, pond, bog (rare), and forest (riparian and oak groves); Typical streams low-gradient and silty					
Shawnee Hills	Escarpment	1.02	Various upland forest types (dry-mesic and mesic); aquatic features include normally clear, medium and high-gradient streams, springs, and sinkhole ponds					
	Crawford Upland	3.03	Upland forest types, few sandstone and limestone glades, gravel washes, and barrens; acid seep spring community (rare)					
Highland Rim	Mitchell Karst Plain	0.67	Predominantly forested, barrens, cave, karst sinkhole pond and swamp (southern, sinkhole), flatwoods, barrens, limestone glade and several upland forest types; medium and high-gradient streams with rocky bottoms (few surface in karst)					
Southern Bottomlands	Southern Bottomlands	2.36	Bottomland forest, swamp, pond, slough, and formerly marsh and prairie					

Table 66. The historic natural community composition for the Middle Wabash Service Area based upon the natural region and section

ELEMENT 4. CURRENT AQUATIC RESOURCE CONDITIONS

4.1 Streams and Rivers

GIS analysis of 303(d) category 4A and 5 impaired streams (IDEM-IR, 2016) indicates there are currently 983 miles of category 4A impaired streams and 2,312 miles of category 5 impaired streams documented in the SA. IDEM reported E. coli (2,126 miles), impaired biotic communities (501 miles), PCBs in fish tissue (484 miles), nutrients (75 miles), dissolved oxygen (65 miles), and pH (43 miles) as current stream impairments within the SA (IDEM-IR, 2016). There are stream reaches in which multiple impairments may occur; therefore there is some overlap with the impaired stream miles.

As of 2014, IDEM conducted QHEI assessments of 445 stream reaches within the SA **(Table 67 and Figure 79)** (IDEM OWQ, 2014). Of the stream and river habitat reaches assessed, 36.85% are capable of supporting a balanced warm water community.

QHEI Score Ranges	Narrative Rating	Count	Percent of Total
<51	Poor Habitat	116	26.07
51-64	Habitat is partially supportive of a stream's aquatic life design	165	37.08
>64	Habitat is capable of supporting a balanced warm water community	164	36.85
	Total	**445**	**100%**

Table 67. IDEM Overall QHEI scores for Middle Wabash SA, 1991 – 2014 (IDEM OWQ, 2014).

As discussed in the statewide portion of the CPF, the functions and services provided by forests are important to the ecological health of aquatic resources in all portions of the SA that were historically forested. Analysis of the 2011 NLCD indicates that the Middle Wabash SA ranks fifth overall in forested cover density of all SA's at 20% of total area with approximately 694,925 acres and is the SA with the fourth highest percentage of forested cover of any SA at approximately 13.3% of 5,215,169 acres of forest cover statewide.

GIS analysis identifies approximately 12,258,927 linear feet (2,322 miles) of stream located within 100 feet of agricultural fields. Under these criteria, the Middle Wabash SA has the third highest ratio of these potentially restorable stream miles to square miles of SA at approximately 0.43 mile of potential restoration per one square mile, or one mile of potential restoration for every 2.33 square miles of SA.

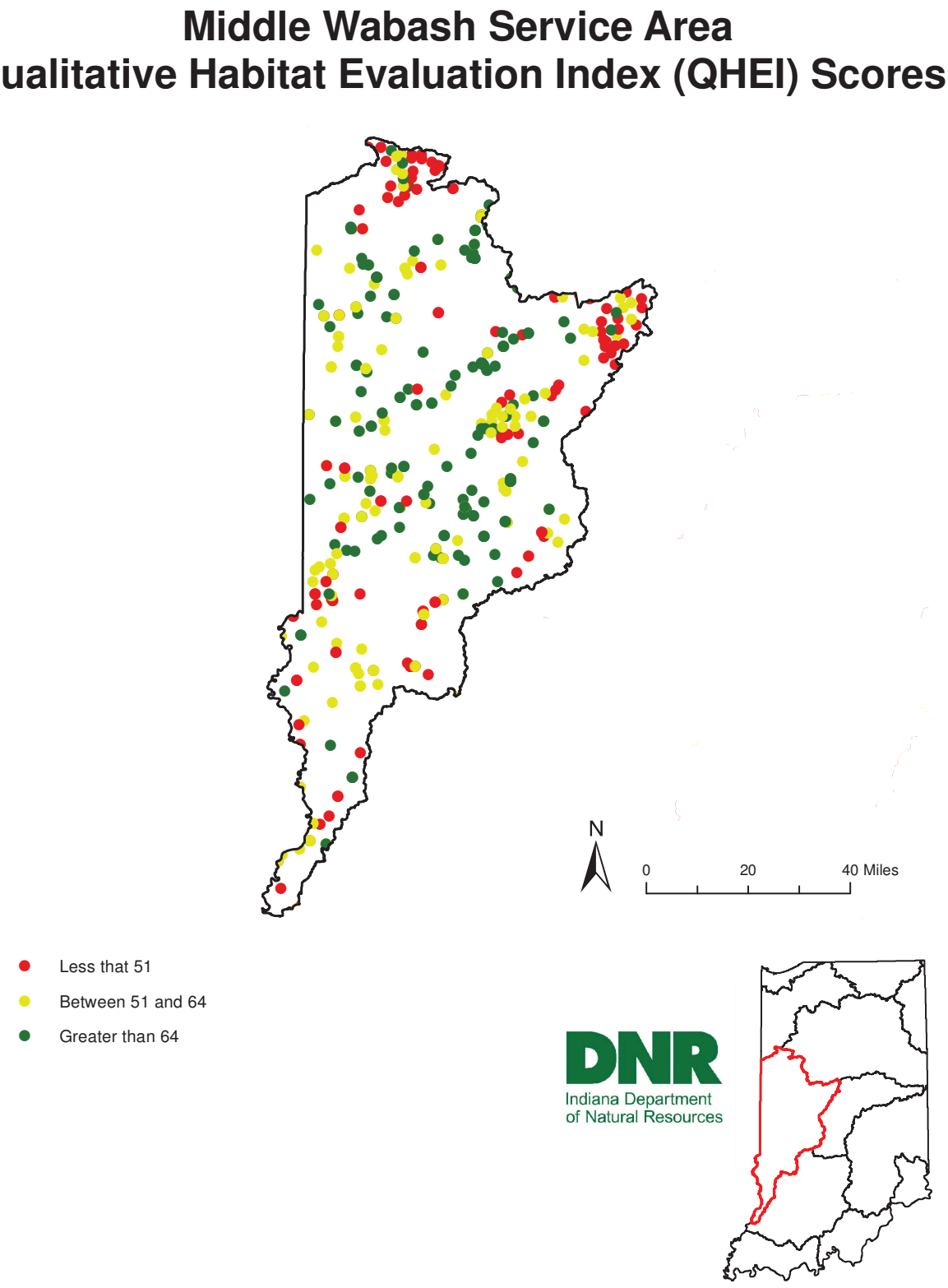

Figure 79. IDEM overall QHEI scores within the Calumet-Dunes service area; 1991-2014 (IDEM OWQ, 2014).

4.2 Wetlands

Analysis of the NWI (USFWS NWI, 2015) in the Upper Wabash SA shows that there are approximately 16,400 acres of freshwater emergent wetland (PEM) and approximately 76,891 acres of combined freshwater forested (PFO) and scrub-shrub (PSS) wetlands, accounting for approximately 2.7% of the total SA acreage. All of the aquatic resource types from the NWI combined account for approximately 5% of the total SA **(Table 68 and Figure 80)**.

Aquatic Resource Type	Sum of NWI Aquatic Resource ACRES in SA	Percent of Total NWI Aquatic Resource Acres in SA	Percent of SA Total Acres	Percent of Total State Area –Acres
Freshwater Emergent Wetland	16,400	9.47%	0.47%	0.07%
Freshwater Forested/Shrub Wetland	76,891	44.38%	2.22%	0.33%
Freshwater Pond	21,114	12.19%	0.61%	0.09%
Lake	15,560	8.98%	0.45%	0.07%
Riverine	43,280	24.98%	1.25%	0.19%
Grand Total	**173,247**	**100.00%**	**5.00%**	**0.75%**

Table 68. Acres and percentage of acres of aquatic resource types from NWI analysis (USFWS NWI, 2015).

Wetlands are most prominent along the Wabash River and its tributaries; wetland densities are most scarce in the Central Corn Belt Plains and Eastern Corn Belt Plains ecoregions in counties such as Montgomery, Putnam, and Warren (IDNR, 1996).

Hydric and partially hydric soils account for 868,962 acres (**Figure 81**), or 25.1% land cover within the SA, out of which approximately 791,286 acres have the potential to be restored accounting for 22.8% of the total SA. This was determined by mapping current hydric and partially hydric soils data (NRCS-USDA, 2016) with potentially restorable land cover types (e.g., cropland, pasture), excluding PFO, PSS and PEM wetlands from the NWI within agricultural land use. The Middle Wabash SA has the 6th highest percentage of recoverable wetland acres to total SA size of all SAs, and the third highest total of potentially restorable wetland acres of any SA. This is partially due to SA size, but also reflective of the dominance of agricultural land use.

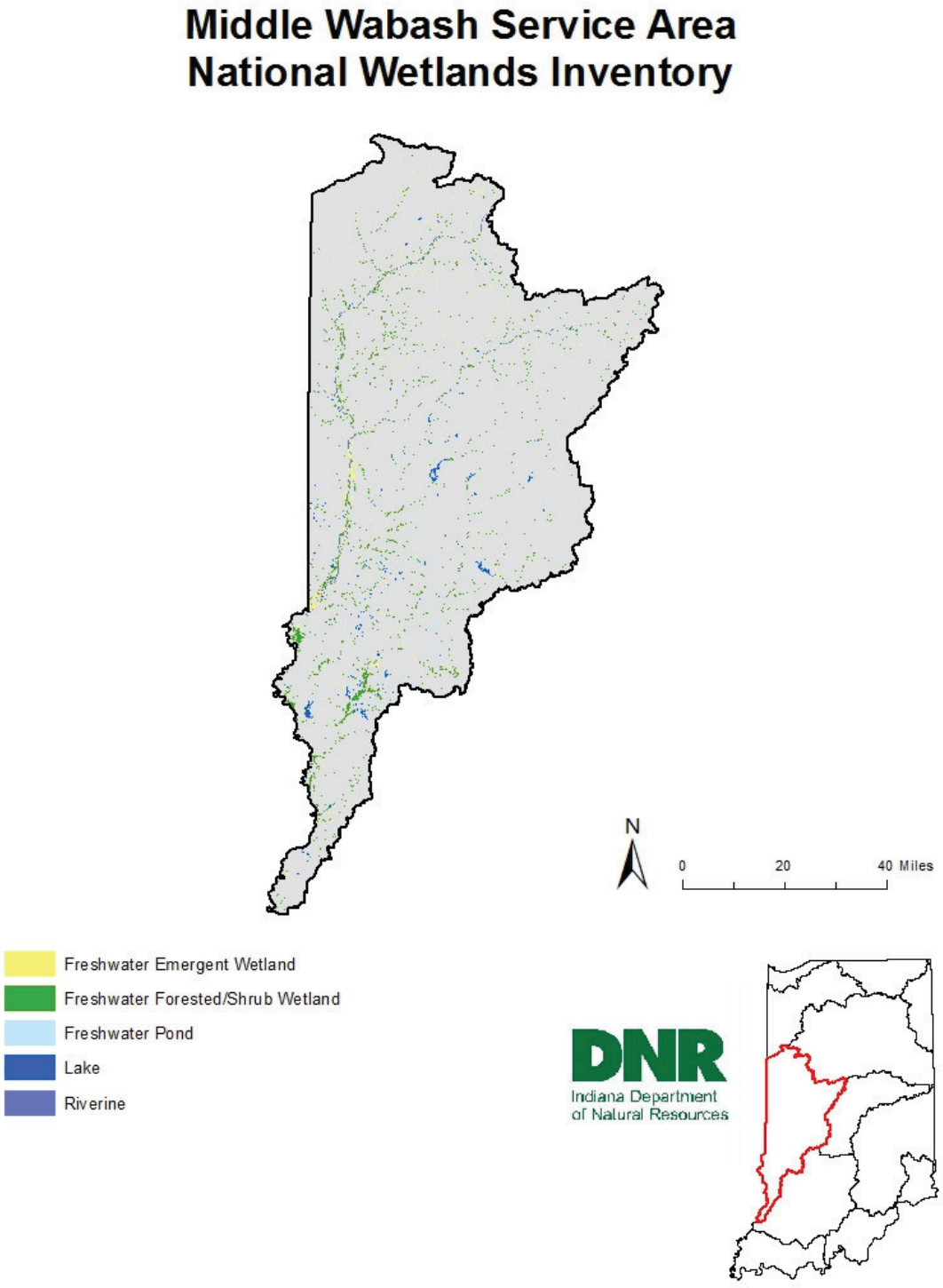

Figure 80. NWI for the Middle Wabash Service Area (USFWS NWI, 2015).

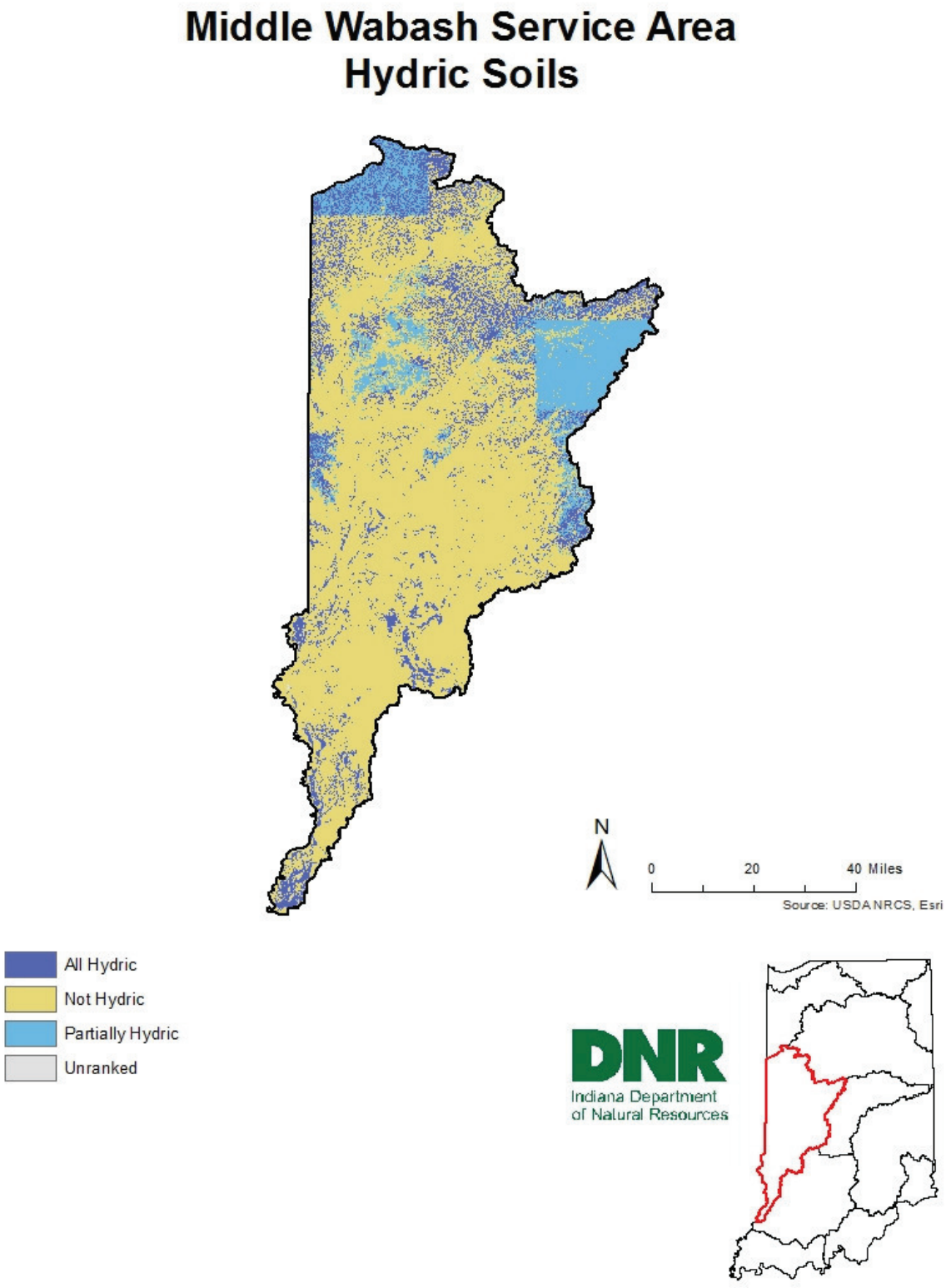

Figure 81. Hydric and partially hydric soils within the Middle Wabash Service Area (NRCS-USDA, 2016).

4.3 Concentrations of Potentially Restorable Wetlands and Streams

GIS hotspot analysis was conducted to document concentrations of the identified potentially restorable wetlands and streams. Hotspots account for 522,766 acres of potentially restorable wetlands within the SA. The watershed with the most hotspots of potentially restorable wetlands is Big Pine Creek (HUC 0512010804 **[Table 69]**).

Hotspots account for 4,366,560 linear feet of potentially restorable streams within the SA. The watershed with the most hotspots of potentially restorable streams is Mill Creek (HUC 0512020305 **[Table 70]**). The watersheds with the highest concentrations of potentially restorable wetlands and streams **(Tables 69 & 70)** serve as the basis of identification of areas that have experienced the most recoverable aquatic resource loss within the SA. **Figure 82** shows where these watersheds are located within the SA.

Approximately 1,033 acres of these hotspots of potentially restorable wetlands are on IDNR-owned lands within the Middle Wabash SA. Approximately 62,565 acres of hotspots of potentially restorable wetlands are adjacent to IDNR-managed lands within the Middle Wabash SA. Pine Creek Bottoms Gamebird Habitat Area is the IDNR-managed land in the Middle Wabash SA with the most adjacent acres of hotspots of potentially restorable wetlands (42,054 acres). Approximately 13,921 linear feet of hotspots of potentially restorable streams are adjacent to IDNR-managed lands. McClellen Gamebird Habitat Area is the IDNR-managed land with the most adjacent hotspots of potentially restorable streams (4,376 linear feet).

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Wetlands (acres)
0512010804	Big Pine Creek	85,687
0512011001	Browns Wonder Creek-Sugar Creek	63,715
0512011004	Prairie Creek-Sugar Creek	48,015
0512020301	East Fork Big Walnut Creek	41,872
0512010803	Mud Pine Creek	37,146

Table 69. Watersheds in the Middle Wabash Service Area with the most hotspots of potentially restorable wetlands.

HUC 10 Code	HUC 10 Name	Hotspots of Potentially Restorable Streams (linear feet)
0512020305	Mill Creek	413,424
0512010804	Big Pine Creek	366,432
0512010812	Cecil M. Harden Lake-Big Raccoon Creek	257,136
0512010803	Mud Pine Creek	230,736
0512011006	Big Shawnee Creek-Wabash River	194,832

Table 70. Watersheds in the Middle Wabash Service Area with the most hotspots of potentially restorable streams

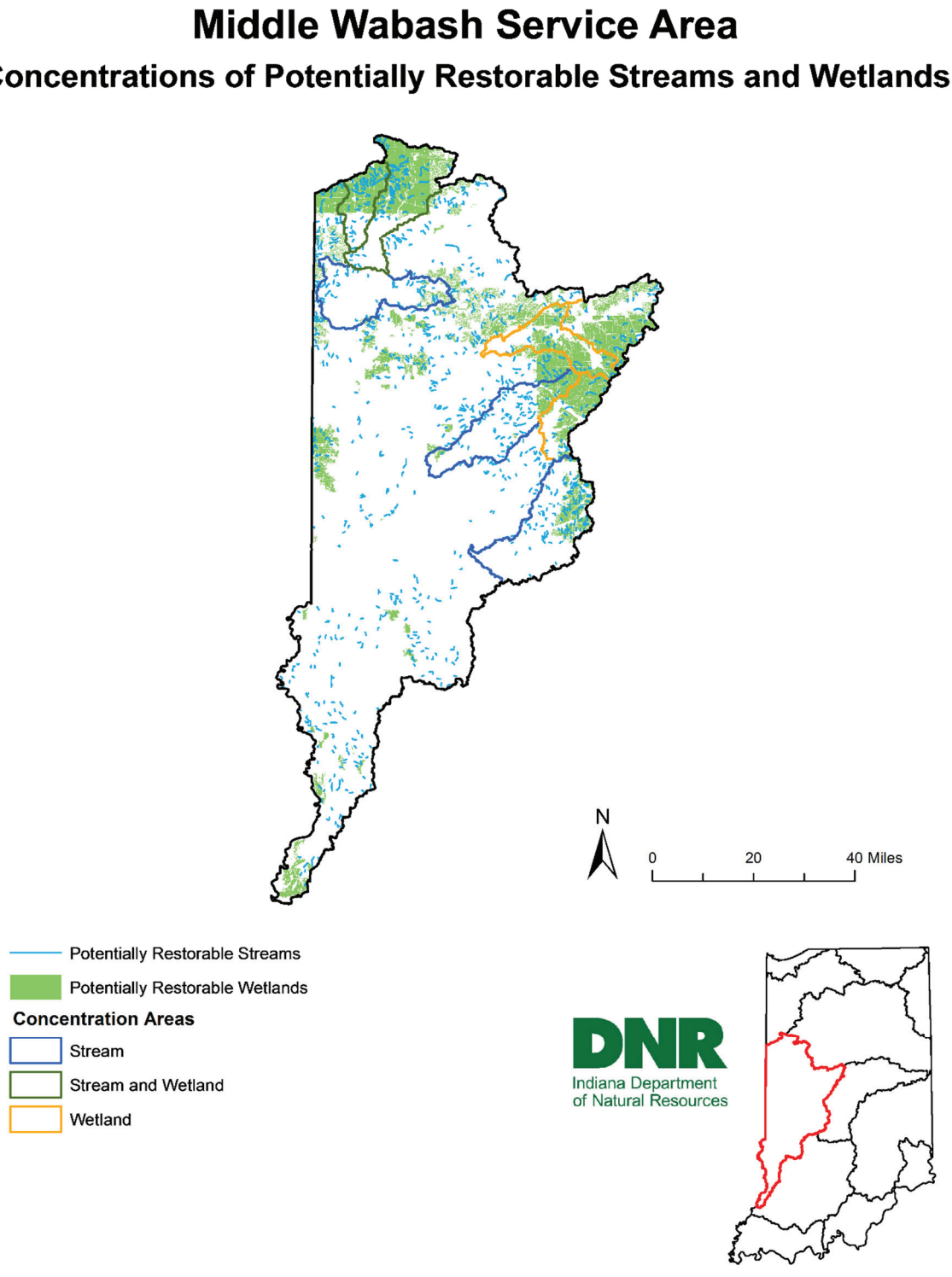

Figure 82. Concentrations of Potentially Restorable Streams and Wetlands in the Middle Wabash Service Area.

4.4 Lakes, Reservoirs and Ponds

GIS analysis of 303(d) lake impairments in the Middle Wabash SA indicates there are two lakes currently documented having category 5 impairments for PCBs in fish tissue, which measured using the National Hydrography Dataset (NHD), accounts for approximately 3,500 acres (IDEM-IR, 2016).

The 2011 NLCD identifies approximately 38,022 acres of open water which accounts for 1.1% of the SA. This varies slightly from the NWI, which identifies approximately 21,114 acres of freshwater ponds comprising of 0.6% of the SA, and 15,560 acres of lakes comprising of 0.5% of total SA acres. There are no PFL's (IC 14-26-2-1.5) located within the Middle Wabash SA. IDNR will remain up to date with reservoir (lake) condition data from sources such as IDEM, the Indiana Clean Lakes Program, watershed management plans, lake associations and the like as the landscape watershed approach is utilized to identify aquatic resource needs within the SA.

4.5 Ground Water and Surface Water Interaction

The data presented in this section will help identify potential areas in need of increased ground water recharge and/or identifying sensitive aquifers in need of increased buffering and protection from potential contamination threats.

Analysis of the near surface aquifer recharge rate data from IGS (Letsinger S. L., 2015) for the Middle Wabash SA shows that approximately 94% of the shallow unconsolidated aquifers receive between three to seven inches of ground water recharge annually **(Table 71).**

Recharge Rate	Inches/Year	Square Miles	Percent of Calumet-Dunes SA
High	14	0.02	0.0003%
	13	0.03	0.001%
	12	0.01	0.0002%
	11	0.36	0.01%
	10	2	0.04%
	9	18	0.34%
	8	77	1.42%
	7	209	3.87%
	6	565	10.44%
	5	1,462	27.04%
	4	1,862	34.43%
	3	983	18.17%
Low	2	193	3.56%
	1	38	0.69%

Table 71. Approximate ground water recharge rates in the Middle Wabash Service Area (Letsinger S. L., 2015).

Analysis of the IGS near surface aquifer sensitivity mapping (Letsinger S. , 2015) indicates that nearly 100% of the Middle Wabash SA near surface aquifers are in the high to low range for sensitivity to contamination, with approximately 53% being moderate **(Table 72)**. The aquifer sensitivity reflects the middle to lower range of aquifer recharge rates.

Sensitivity	Square Miles	Percent of Total Acre
Very High	4	0.08%
High	785	15%
Moderate	2,860	53%
Low	1,754	32%
Very Low	6	0.10%

Table 72. Ground water sensitivity distribution in the Middle Wabash Service Area (Letsinger S. , 2015).

Analysis of the IDNR Division of Water's Water Rights Section 2015 significant water withdrawal facilities data (IDNR DOW, 2016) shows the Middle Wabash SA is third among SA's for registered capacity of surface water withdrawal with a 2015 withdrawal capacity of 491,259 MGD **(Figure 82)**. Energy production accounts for approximately 99.7% of registered withdrawal capacity with industrial and agricultural irrigation accounting for the remainder.

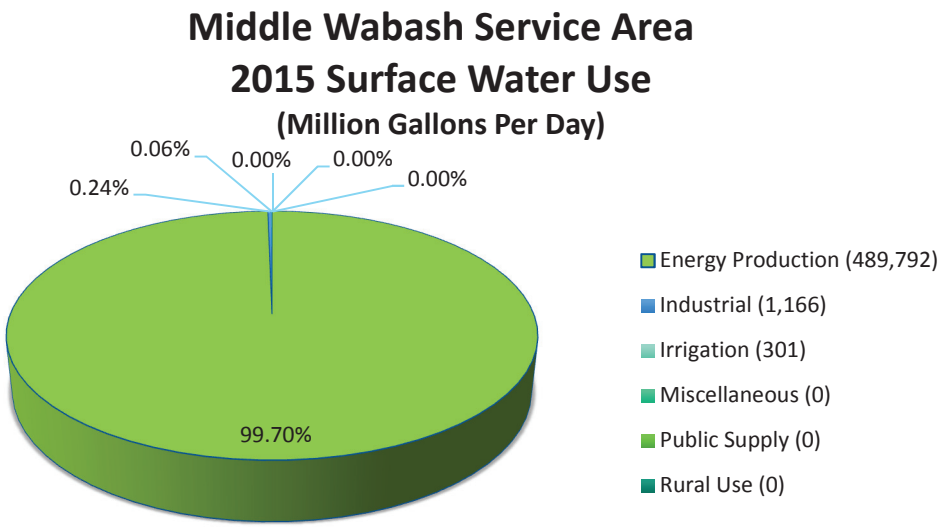

Figure 82. 2015 surface water usage in the Middle Wabash Service Area (IDNR DOW, 2016).

Significant ground water withdrawal in the Middle Wabash SA is the second most of any SA with a 34,897 MGD registered capacity **(Figure 83).** Public water supply accounts for approximately 55% of registered ground water withdrawal capacity in the SA, followed by industrial uses with 22%, agricultural irrigation with 16%, and energy production with 7%.

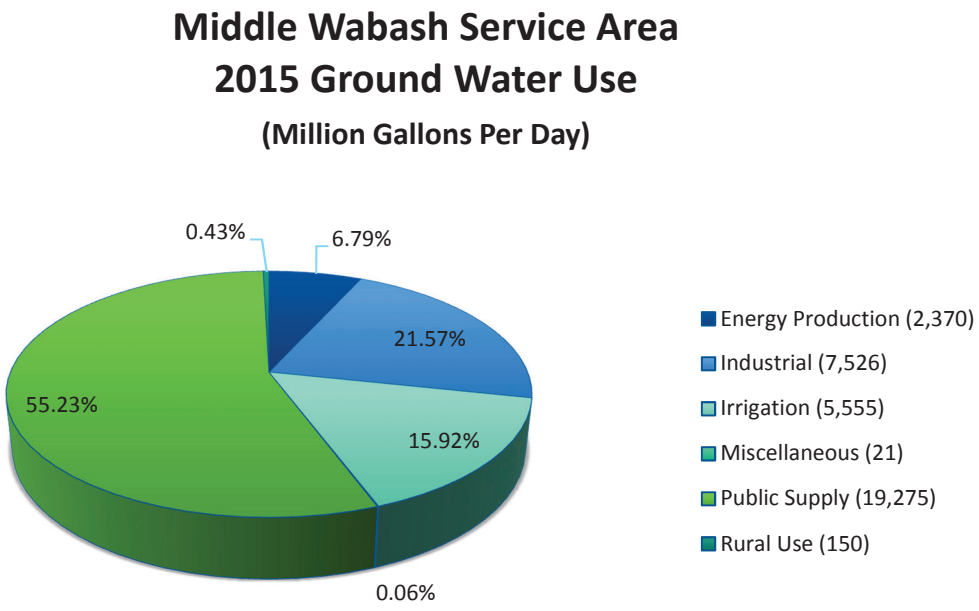

Figure 83. 2015 ground water usage in the Middle Wabash Service Area (IDNR DOW, 2016).

4.6 High Quality Aquatic Resources and Natural Communities

In addition to previous eco and natural region descriptions of this SA, high quality natural communities currently documented in the Natural Heritage Database within the Middle Wabash SA include, but are not limited to, acid seep, circumneutral seep, fen, forested swamp, marsh, shrub swamp, and wet floodplain forest, in addition to many other mixed, transitional and upland communities.

There are currently a minimum of seven amphibian species, 47 bird species, 10 fish species, 17 mammal species, 15 mollusk species, and 11 reptile species listed as SGCN within the Corn Belt, Valleys and Hills, and Interior Plateau SWAP Planning Regions within the Middle Wabash SA (SWAP, 2015).

ELEMENT 5. AQUATIC RESOURCE GOALS AND OBJECTIVES

Aquatic resource goals and objectives identified in the statewide CPF also apply to the Middle Wabash SA. The following aquatic resource goals and objectives apply specifically to the Middle Wabash SA based on 404 permitted impact trends, predominant threats, historic loss, current impaired and high quality aquatic resource conditions, habitats and SGCN, and current and future priority conservation areas. The general amounts of aquatic resources IDNR will seek to provide will depend on ILF credit demand.

1. Restoration, enhancement and preservation of aquatic resources that will help offset current and anticipated threats within the SA.

2. Re-establishment of historic aquatic resources that have experienced high concentrations of loss, fragmentation and/or impairment, such as the identified concentrations of potentially restorable streams and wetlands to include any channel restoration needs.
3. Implement projects within and adjacent to current and future areas identified as conservation priorities by federal, state and local government entities, and non-governmental organizations (stakeholder involvement/conservation partnerships) including the Healthy Rivers Initiative.
4. Preservation of rare and high quality aquatic resources; critical habitat for rare and endangered species; priority habitat for species of greatest conservation concern; and/or other areas meeting the requirements of 33 CFR §332.3(h).
5. Implement natural stream channel restorations in order to help offset chemical, physical and biological impairments and degradation resulting from anthropogenic activities to include considerations such as in-stream habitat, physical integrity, riparian cover, and/or potential removal or modification of dams.
6. Support critical habitat restoration for federal and state listed SGCN within and adjacent to aquatic resources while applying the SWAP identified conservation needs and actions in the Eastern Corn Belt, Interior River Valleys and Hills, and Interior Plateau Planning Regions where feasible.
7. Support efforts to offset aquatic resource degradation associated with historic mining activities throughout the service area.

ELEMENT 6. PRIORITIZATION STRATEGY

The four steps below present the prioritization criteria for mitigation site identification and selection. This prioritization strategy will be used for project selection within each SA. When prioritizing sites for mitigation projects, the following **core criteria** shall be utilized.

1. Mitigation site proposals must contain the ability to result in a successful and sustainable net gain and/or preservation of aquatic resource functions and services and/or result in no net loss of Indiana's aquatic resources.
2. Prioritization will be given to compensatory mitigation projects that provide the greatest benefit to the Middle Wabash SA, by providing the greatest lift in aquatic resource functions and services based upon the specific needs identified within the SA and/or watershed utilizing the watershed approach for site selection.
3. Project proposals will consider how to help offset the anthropogenic threats to aquatic resources, historic loss, and existing and future impairments while achieving IN SWMP goals and objectives, within the SA.
4. Other prioritization evaluation criteria may include, but are not limited to; cost, feasibility, size, proximity to other conservation lands or protected areas, connectivity or location with respect to corridors, human use value, and efficient long term maintenance.

In addition to the Core Criteria, information from conservation partners, landowners and additional stakeholders may also be utilized during the site selection process as they may have additional data or a pre-existing list of priority restoration projects. Ground investigations will be required to confirm or dismiss these datasets and determine the best locations for compensatory mitigation project sites.

ELEMENT 7. PRESERVATION OBJECTIVES

When applicable under 33 CFR §332.3(h) of the Federal Mitigation Rule, preservation objectives within the Middle Wabash SA will include rare and high quality natural aquatic and riparian communities, waters having a significant contribution to ecological sustainability, and important habitat for SGCN while addressing the physical, chemical, or biological functions provided to the watershed that address critical conservation needs throughout the service area. Additionally, there will likely be aquatic resource and habitat preservation and/or enhancement opportunities in coincidence with the primary objective of restoration to be determined on a per project basis and approved by the Corps/IRT.

ELEMENT 8. PUBLIC AND PRIVATE STAKEHOLDER INVOLVEMENT

Currently, the following land trusts exist within the SA: Ouabache Land Conservancy, Indiana Karst Conservancy, Four Rivers RC&D, NICHES Land Trust, Sycamore Land Trust, and Central Indiana Land Trust. There is the potential for land trusts to dissolve, adjust their geographical boundaries, and for new land trust organizations to be created within the SA. IDNR will work with the land trusts that exist in the SA over the life of the program.

Currently, the following watershed plans exist within the SA: Big Walnut-Deer Creeks WMP, Busseron Creek WMP, Lake Manitou WMP, Lake Maxinkuckee WMP, Little Sugar Creek WMP, Little Vermillion River WMP, Little Wildcat Creek WMP, Lower Eel River WMP, Region of the Great Bend of the Wabash River WMP, South Fork Wildcat WMP, Lauramie Creek WMP, Spring Creek-Lick Run WMP, and Turtle Creek WMP. However, IDNR will utilize the most current watershed planning information that is available as these plans are updated and/or new watershed plans are developed within this SA over the life of the program.

Additional stakeholders' interest and potential conservation partnerships specific to the Middle Wabash SA, and in which IDNR is an interested party include, but are not limited to the following organizations and/or initiatives:

- USGS Indiana Water Science Center
- USGS Illinois Water Science Center
- Eastern Tallgrass Prairie and Big Rivers, and Appalachian Landscape Conservation Cooperatives
- Friends of Sugar Creek
- Municipal and County governmental entities
- Municipal Separate Storm Sewer Systems (MS4) Communities
- Active Watershed Groups and appropriate Watershed Management Plans
- West Central Indiana Economic Development District
- Southern Indiana Development Commission
- North Central Indiana Regional Planning Council
- Kankakee-Iroquois Regional Planning Commission
- Wabash River Enhancement Corporation Heritage Corridor Commission
- Mississippi River Basin Initiative

Currently known public, private and non-profit conservation priority areas as identified by the 2015 IWPP (IWPP, 2015) are shown in **Figure 84** below.

ELEMENT 9. LONG TERM PROTECTION AND MANAGEMENT

Long term protection and management strategies will be conducted in the same manner per SA as outlined in the statewide CPF.

ELEMENT 10. PERIODIC EVALUATION AND REPORTING

Periodic evaluation and reporting on the progress of IN SWMP will be conducted in the same manner per SA as outlined in the statewide CPF.

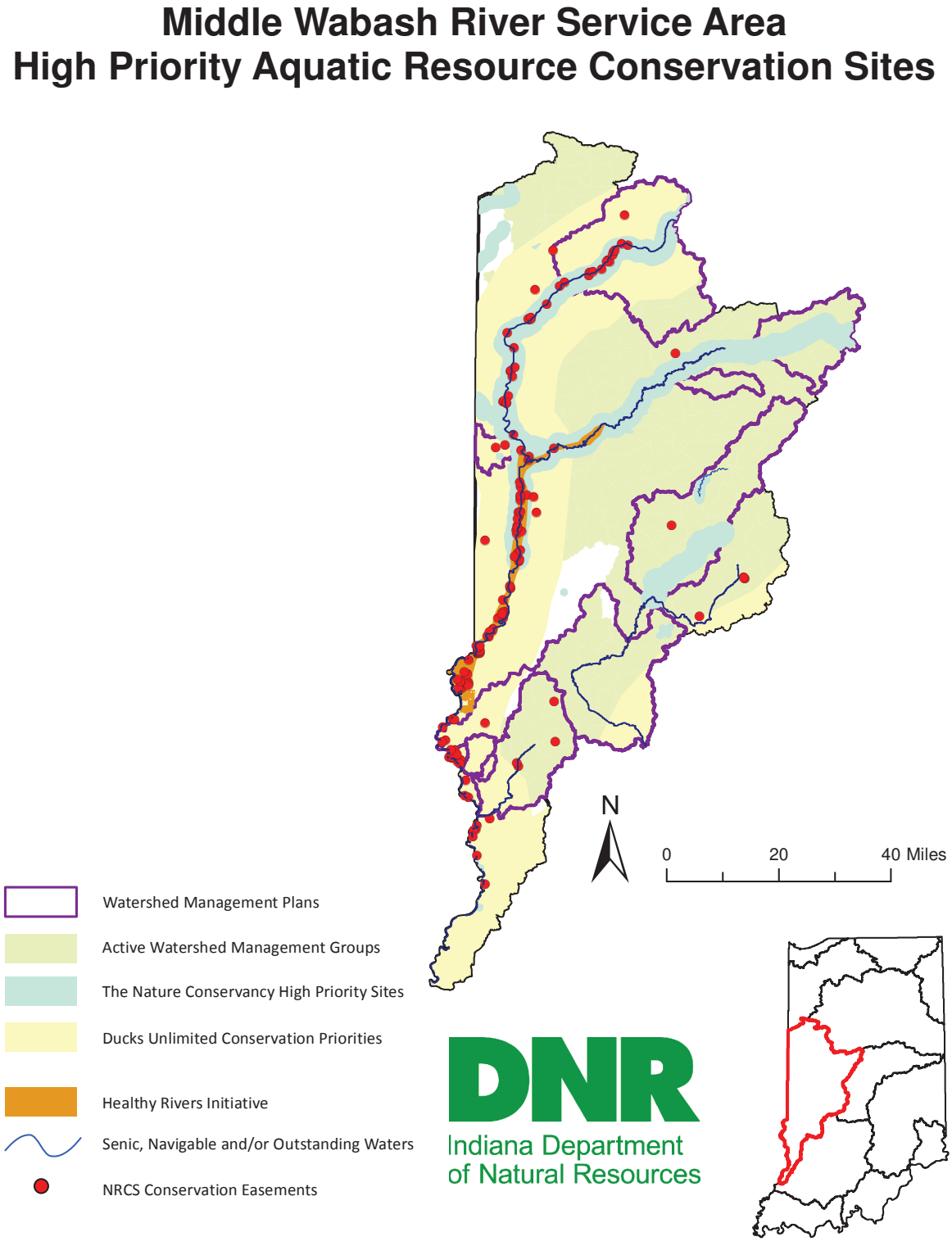

Figure 84. Priority aquatic resource conservation groups and sites within the Middle Wabash Service Area (IWPP, 2015).